

A Work Project, presented as part of the requirements for the Award of a Master Degree in International Management from the NOVA – School of Business and Economics.

WaveDock Buoy: Disrupting wave energy application for remote offshore operations in the Sea-Mining industry

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A Project carried out on the Master in International Management Program, under the supervision of:

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Abstract

Climate change is the defining challenge of our time, with Carbon Dioxide representing the most important long-lived forcing of this emergency. Oceans are increasingly recognized as indispensable for addressing this global challenge, and the yet unexploited energy generated by waves is the key for a sustainable future. Through this research project our team provides an effective and environmentally driven solution for a better execution of remote offshore operations by harnessing all the potential of wave energy. More particularly, the implementation of this solution will overcome the numerous constraints of sea-mining, which represents one of the fastest growing Blue-economy sectors.

Keywords: **Wave Energy; Buoy; Autonomous Underwater Vehicles; Sea-Mining**

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Cost-Benefit Analysis



COST OF RECHARGING AUV

= 67 (times vessels are deployed) x
30.000 (Cost of vessel hire

intervention) = **2,010,000 €**

VS



9-MONTH LEASE WAVEDOCK

= **1,300,000 €**

710,000 € cost-cut



WaveDock Impact on CO2 Emissions

Tonnes CO2 emissions = 0,592 per travel

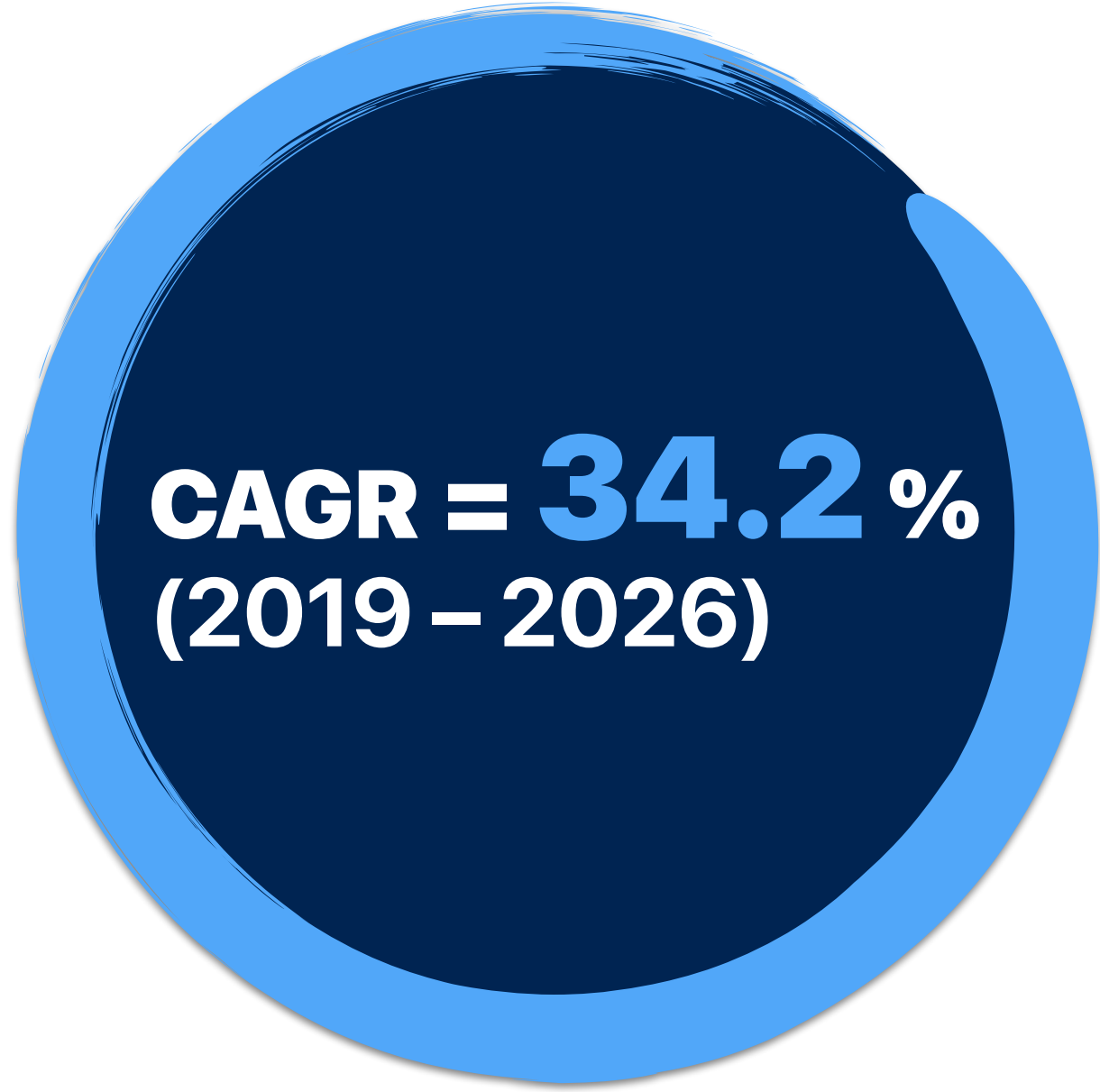
- **1 WD Buoy ↓ 80 tonnes of CO2***
- **3 WD Buoy ↓ 240 tonnes of CO2***
- **8 WD Buoy ↓ 640 tonnes of CO2***

*** Reduction per mission**



Sea-mining – Market Trends

- **Sea-mining market expected to reach USD **7.05** billion by 2026**



**CAGR = 34.2 %
(2019 – 2026)**

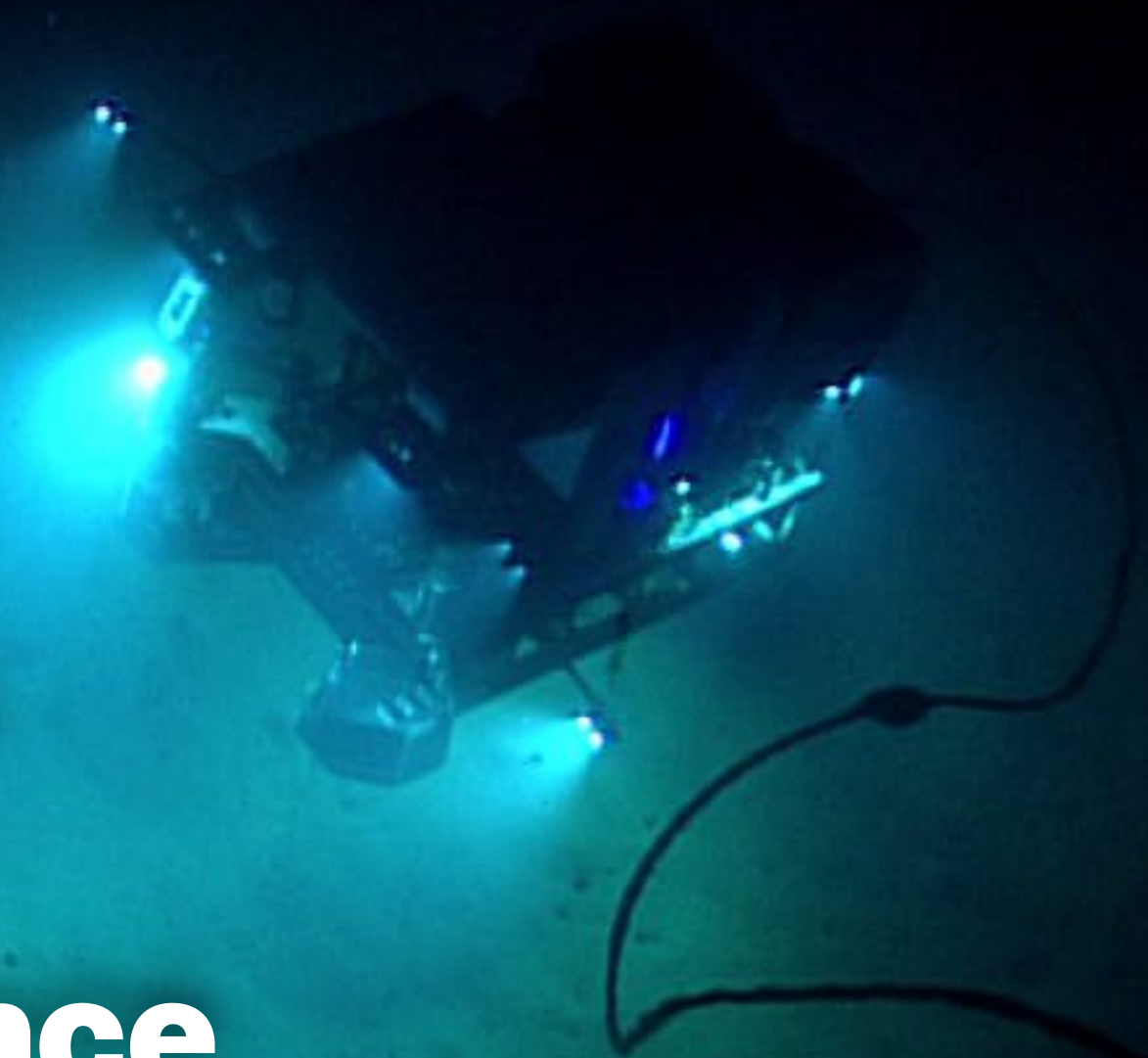
**Depleting land-based
mineral resources and
skyrocketing metal demand**

Source: Frontiers in Marine Science. 2018. "An Overview of Seabed Mining Including the Current State of Development, Environmental Impacts, and Knowledge Gaps". Accessed September 29th.

<https://www.frontiersin.org/articles/10.3389/fmars.2017.00418/full>

Sea-Mining Market Challenges

- **Triggering environmental protests**
- **Restriction of AUVs power endurance**
- **Pressure and temperature as barriers to the proper functioning of the docking station**





Sea-Mining Market — Opportunity

Thanks to the deployment of high-quality and pressure-resistant components

WaveDock Buoy will be able to guarantee a continuous flow of electricity for AUVs while bearing effectively the hostile conditions involved in deep-sea mining activities

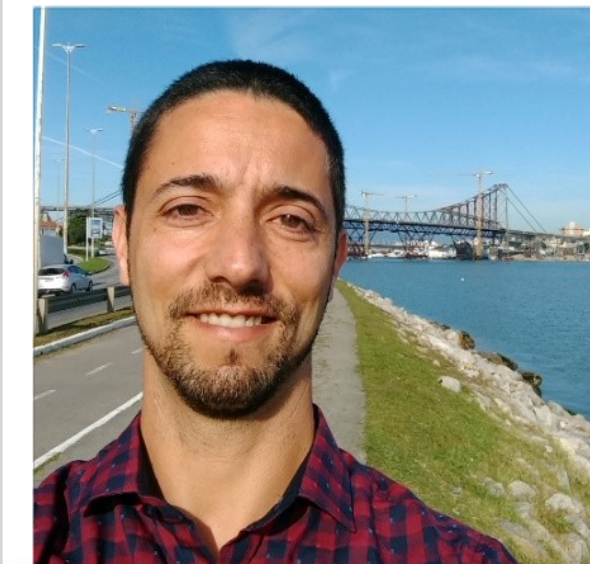
Business Development Strategy

- Offering tailored solutions in the form of ad-hoc contracts and agreements

Direct Sales Team



Francesco De Bellis



Pedro Ribeiro

SALES REP
Specialist O&G

SALES REP
Specialist Military

SALES REP
Specialist Sea-Mining

Business Development Strategy

O&G -

Gradual customer acquisition due to risk averse profile

Military Sector -

Direct negotiation with defense state agencies

Sea Mining -

Initial focus exclusively on SMEs and aimed switch to top industry players

Pricing Strategy – First phase

Price Benchmarking: OPT PB3 Buoy leased at € 1.750.000

Go-to-market and commercial expansion Phase (2022-2026)

- **Market Penetration Pricing**
- **9-months leasing contracts at 1.300.000 euros**
- **13% less than competition**

Pricing Strategy – Second phase

Price Benchmarking: OPT PB3 Buoy leased at € 1.750.000

Maturity Phase (2026 - onwards)

- **Market Skimming Pricing**
- **9-months leasing contracts at 1.900.000 euros**
- **9% more than competition**

IP Strategy – Relationship with Técnico Lisboa

WaveDock is a Spin off company of the Instituto Superior - Técnico

The IP rights will be assigned " free of charge" with the university's return coming exclusively from its shareholding in the company (10%). The remaining stake will be equally distributed between the 4 co-founders (22,5% each)



The power conversion system



The buoy design



WaveDock

Intellectual Property Strategy

Our company will be supported by CMS, a top IP law firm specialized in solving disputes in the renewable energy sector

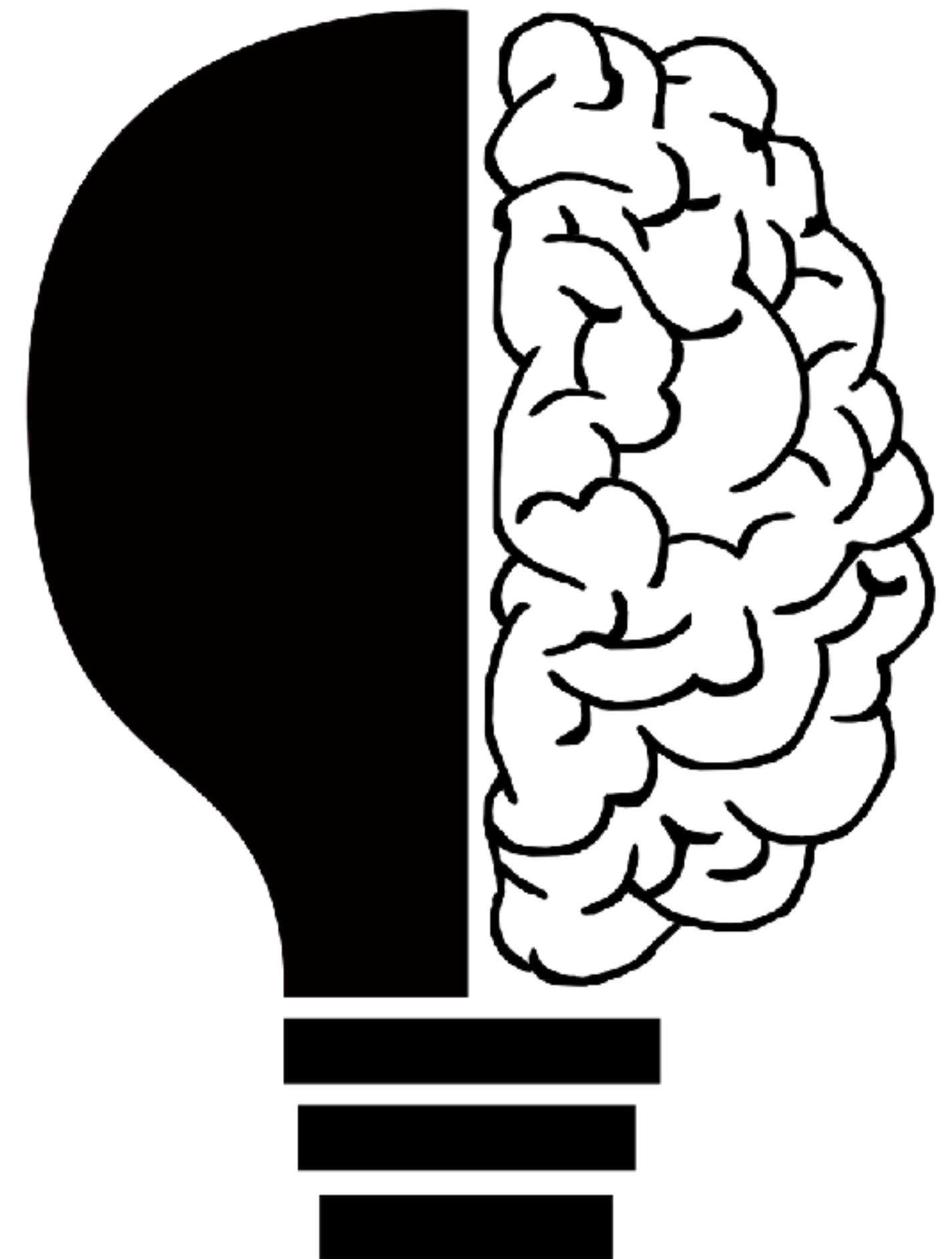


Patents

- **Protection of power conversion system and buoy design**

Licensing Agreements

- **Exclusive use of our suppliers' components**



Intellectual Property Strategy

Trademark

- **Protection of the logo WaveDock™**

Trade secrets and non-disclosure agreements

- **Limited access to our know-how and technological innovation**



Potential IP Risks

- 1. Confidentiality of our information and know-how**
- 2. Limits of foreign laws (time, red tape, ecc)**
- 3. Infringement upon IP rights of third parties**

VS

How To Mitigate Them

- 1. Insert non-disclosure provisions in employment agreements**
- 2. Operate in accordance with the PTC (Patent Cooperation Treaty) procedure**
- 3. Freedom-to-operate analysis**

Key Customers: Sea-mining Sector

DE BEERS GROUP

- **Development of geophysical survey systems**
- **Adopted AUVs as the primary survey platform**
- **Ocean powering station to boost mineral resource development**



Neil Ventura

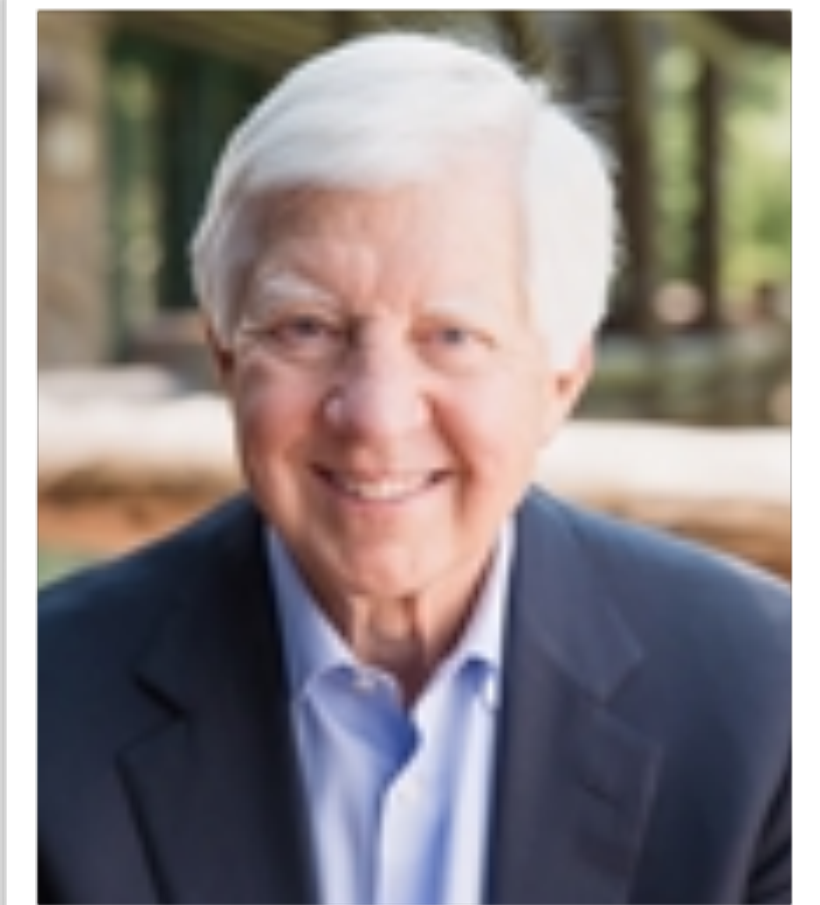
Executive Vice-President, Strategy and Innovation

Contact we will be dealing with during the negotiation phase

Key Customers: Sea-mining Sector



- **Seafloor minerals exploration and extraction**
- **AUVs used for ocean mining exploration**
- **Current AUVs are limited by their on-board energy storage capability**



John Morris

CEO of Neptune Minerals

Contact we will be dealing with during the negotiation phase